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Comparative Effect of Different Recovery Programmes on Blood Lactate

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Abstract – Present study was undertaken to investigate the comparative effect of different recovery programmes on Blood Lactate. A sample of Twenty (20) state level basketball players with age group of 18 to 23 years belong to Birbhum, WB India were purposively selected as subjects for the study. Further all the subjects were randomly divided into four groups and each group had 05 subjects. Three experiential groups and one control groups were formed i.e. Experimental Group-I (Cold Water Immersion group, CWIG), Experimental Group-II (Massage group, MG),Experimental group-III (Low Intensity Stretching Group, LISG) and Control group (CG).

Before beginning the training program all the subjects were informed about the purpose and procedure of study. Data on Blood Lactate was collected before the beginning of basketball match, immediately after the basketball match and after the implementation of training programs on experimental groups.The experiment was conducted during inter-club basketball tournament at sport authority of India special game centre KabiguruKrirangan, Bolpur, Birbhum, (W.B.). First of all pre data was collected before starting the match then subject were playing a full length basketball match for 40 min thereafter the data was be collected and there after 15 minutes recovery programs were implemented and final data was collected after the training programs. Data was collected by medical doctor with proper supervision and guidance of the research scholar whereas control group did not participate in any recovery programs.

In order to compare the effect of three types of recovery programs (Cold Water Immersion Program, Massage Program and Low Intensity Stretching Program) on Blood Lactateof state level basketball players, descriptive statistics, 4x3 Mixed (Between-Within) repeated ANOVA was used as the statistical techniqueat 0.05 level of significance. In case of significant difference, pairwise comparisons were performed after Bonferroni adjustment.

Results of the study revealed that statistically significant difference was found in main effect of training duration whereas no significant interaction effect was found between groups and training duration. Pairwise comparison between recovery durations of recovery programme of Blood Lactate shows that significant difference were found between pre match- post match and post match- after recovery, whereas no significant difference was found between pre match and after recovery. The significant change was found in Blood Lactate, among basketball players after administration of different recovery programs and for the fast and better recover of basketball players cold water immersion recovery programme was better than other recovery programme (massage and low intensity stretching).

Keywords: Blood Lactate, Basketball Players and Recovery

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INTRODUCTION

Training and competition loads enhance sports performance. In the process of long term training, the quantum of load is gradually increased and this leads to improved performance. A beginner adapts to training load faster whereas with the increase in training age, higher load are administered and this result in slower increase in performance. Sportsperson cannot effectively undertake very high loads of training unless proper means are adopted to accelerate the process of recovery. Administering appropriate means can ensure quicker recovery and make a sports person capable of undertaking more frequent loads.

In today's competitive sports environment, discovering effective recovery methods of

facilitating optimal athletic performance is paramount to success. The recovery period is essential in maintaining athletes' physical, psychological and physiological well-being and crucial in the pursuit of intense physical training or competition and satisfying performance. Recovery for performance in sports presents techniques and modalities currently used to enhance athletes' recovery, optimize training time and avoid overtraining. Recovery after training and competition allows athletes to return to their normal physiological and psychological state as rapidly as possible. This is employed so that performance in next competition or training session will not be unduly compromised by muscle soreness and fatigue. There is now increasing scientific evidence supporting the benefits of recovery to enhance exercise performance in a number of domains, so selection of proper recovery means is indispensible factor for athletes.

Mechanism of loading in sports training involves application of load as well as recovery process. In fact loading and recovery are considered to be two important aspects of the same unit- training load. Therefore these two processes have been studied and analyzed for understanding their functioning. A sufficient number of research works have conducted to analyze the aspect of loading. On the other hand there are not many investigations to analyze and understand the recovery process.

By recovery we understand the process of coming back to the normal state of physiological functioning after being disturbed with training load due to participation in games and sports or exercise. Physiologically the process of recovery has been effectively measured using different tests like recovery pulse testing. There are different conventional recovery programmes used by sports trainees. Some of them are complete rest, massage, cryotherapy, hydrotherapy, thermotherapy, contrast therapy, no steroidal anti-inflammatory drugs, compression garments, stretching, progressive muscle relaxation technique, autogenic relaxation technique, and dietary interventions. It is also possible that combination of recovery interventions offer the most effective recovery benefits to the athlete.

METHODOLOGY

A sample of Twenty (20) state level basketball players with age group of 18 to 23 years belong to Birbhum, WB India were purposively selected as subjects for the study. Further all the subjects were randomly divided into four groups and each group had 05 subjects. Three experiential groups and one control groups were formed i.e. Experimental Group-I (Cold Water Immersion group, CWIG), Experimental Group-II (Massage group, MG), Experimental group-III (Low Intensity Stretching Group, LISG) and Control group (CG).

Before beginning the training program all the subjects were informed about the purpose and procedure of study. Data on Blood Lactate was collected before the beginning of basketball match, immediately after the basketball match and after the implementation of training programs on experimental groups. For the Blood Lactate variable blood sample of each subjects were taken by a doctor from the radial artery &hemacytometer was used for taking blood and testing of blood sample was done at New Nirikshan Pathological Laboratory Sian, Bolpur, Birbhum. Blood Lactate recorded in mmol per liter. The data was collected by administering the standard test and procedure for selectingBlood Lactate. Before collecting data and giving recovery program, the purpose of study was explained to all the subjects and participated voluntarily. A measurement of Blood Lactate was taken at the beginning of the basketball match, after the basketball match and after the experimental period of recovery. The experiment was conducted during inter-club basketball tournament at sport authority of India special game centre Kabiguru Krirangan, Bolpur, Birbhum, (W.B.). First of all pre data was collected before starting the match then subject were played a full length basketball match for 40 min thereafter again data was collected and final data was collected after 15min. of recovery programmes under the proper supervision and guidance of the scholar whereas control group did not participate in any recovery program.

Statistical Technique

In order to compare the effect of three types of recovery programs (Cold Water Immersion Program, Massage Program and Low Intensity Stretching Program) on Blood Lactateof state level basketball players, descriptive statistics, 4x3 Mixed (Between-Within) repeated ANOVA was used as the statistical technique and the level of significance was set at 0.05.In case of significant difference, pairwise comparisons were performed after Bonferroni adjustment.

RESULT

Table-1

Descriptive Statistics of Pre Match, Post Match and after Recovery Mean Data for Blood Lactate

	Groups	Mean	Std. Deviation	N
Pre Match	Cold Water Immersion Group	.24	.03	5
	Massage Group	.27	.06	5
	Low Intensity Stretching Group	.24	.03	5
	Control Group	.26	.04	5
	Total	.25	.04	20
Post Match	Cold Water Immersion Group	.30	.06	5
	Massage Group	.31	.07	5
	Low Intensity Stretching Group	.31	.07	5
	Control Group	.32	.06	5
	Total	.31	.06	20
After Match	Cold Water Immersion Group	.21	.04	5
	Massage Group	.24	.03	5
	Low Intensity Stretching Group	.28	.07	5
	Control Group	.29	.04	5
	Total	.25	.05	20

Table-1 shows the scores of mean and SD of Blood Lactate of different groups and time durations of basketball match. The pre-match mean scores and SD of Blood Lactate for the cold water immersion group, massage group, low intensity stretching group and control group were 0.24±0.03; 0.27±0.06; 0.24±0.03; 0.26±0.04 respectively.

After match training duration, the mean scores and SD of Blood Lactate for the cold water immersion group, massage group, low intensity stretching group and control group were 0.30±0.06; 0.31±0.07; 0.31±0.07; 0.32±0.06 respectively.

The mean scores and SD of Blood Lactate after recovery of cold water immersion group, massage group, low intensity stretching group and control group were 0.21±0.04; 0.24±0.03; 0.28±0.07; 0.29±0.04 respectively

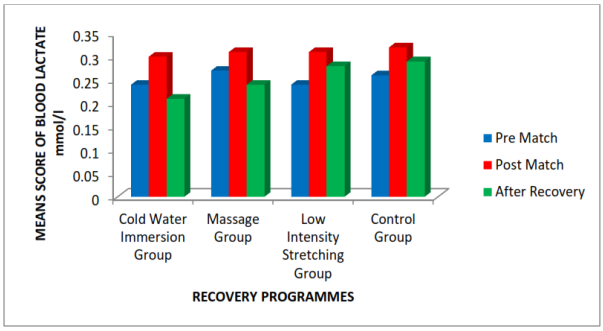

FIGURE-1 Graphical Representation of Blood Lactate between Pre, Post and After Recovery Test Means among the Four Groups

Table-2

Box's Test of Equality of Covariance Matrices of the data for Blood Lactate

Box's M	31.26
F	1.11
df1	18
df2	904.63
Sig.	.33

One of the assumptions of the mixed design is that the pattern of inter-correlations among the levels of the within factors should be similar in different levels of the between-subjects factor. This assumption holds true if the Box's M test is non-significant. It can be seen in table-2 that the Box's test is insignificant ($p > 0.001$); hence the assumption of homogeneity of variance-covariance matrices is not violated.

Table-3

Mauchly's Test of Sphericity of the data for recovery Duration of Blood Lactate

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	Df	P value	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Time	.95	.77	2	.67	.95	1.00	.50

The sphericity assumption is required to be tested in mixed design because it has a within-subjects factor, and it is tested by means of Mauchly's W test. For sphericity assumption to be true, the Mauchly's test should be non-significant. Table 3 shows that the Mauchly's W test is insignificant ($p > 0.05$); hence the sphericity assumption is not violated.

Table-4

Levene's Test of Equality of Error Variances of the data for Blood Lactate

	F	df1	df2	Sig.
Pre Match	.93	3	16	.44
Post Match	.27	3	16	.84
After Match	2.68	3	16	.08

This assumption is required to be tested because the mixed design consists of between-subjects factor also. This is an assumption of the independent measures of ANOVA. Since, the Levene's statistic for pre match and post match and after recovery level of the within-subjects factors (Duration) is non-significant ($p > 0.05$) as shown in the table 4; hence the homogeneity of variance assumption is not violated.

Table-5

F-Table for recovery Durations (Within-Subject Effect) and Interaction Effect of recovery programme of Blood Lactate

Source		Type III Sum of Squares	Df	Mean Square	F	P value
Duration	Sphericity Assumed	.041	2	.020	22.48	.00
Duration * Groups	Sphericity Assumed	.012	6	.002	2.13	.07
Error (Duration)	Sphericity Assumed	.029	32	.001		

*p-value < 0.05 is significant.

Table 5 shows that there was a significant main effect of training durations on Blood Lactate as the calculated F-value (22.48) was found to be greater than tabulated f value (F=3.30) with 2, 32 df at 0.05 level of significance (p-value < 0.05). whereas no significant interaction effect between groups and training durations was found as the calculated F-value (2.13) was found to be lesser than tabulated f

value (F=2.40) with 6, 32 df at 0.05 level of significance (p-value >0.05).

In the mix design there are two independent factors, duration and groups, whose effects needs to be investigated. Here the duration is a within-subjects factor and training groups is a between-subjects factor. InBlood Lactate, the interaction effect is insignificant; hence analyzing the main effects becomes meaningless.

Table-6

F- Table for Groups (Between-Subjects Effects) of recovery programme of Blood Lactate

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Groups	.011	3	.004	.47	.705
Error	.124	16	.008		

Table 6 shows that there was no significant main effect of groups (cold water immersion, massage, low intensity stretching and control) on Blood Lactate due to basketball match as the calculated F-value (0.47) was found to be less than the tabulated f value (F=3.24) with df 3, 16 at 0.05 level of significance (p-value > 0.05).

Table-7

Marginal Means of Blood Lactate among recovery durations Irrespective of Groups of Blood Lactate

Duration	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Pre Match	.25	.01	.23	.28
Post Match	.31	.01	.28	.34
After Recovery	.25	.01	.23	.28

From the above table it is clearly seen that marginal mean of Blood Lactate for overall pre match irrespective of groups (cold water immersion, massage, low intensity stretching and control) suggests that its mean score and standard error are 0.25 and 0.01 respectively. The marginal mean of Blood Lactate for overall post match irrespective of groups (cold water immersion, massage, low intensity stretching and control) suggests that its mean score and standard error are 0.31 and 0.01 respectively. The marginal mean of Blood Lactate for overall after recovery irrespective of groups (cold water immersion, massage, low intensity stretching and control) suggests that its mean score and standard error are 0.25and 0.01 respectively. Marginal means of all the training durations are presented graphically below:

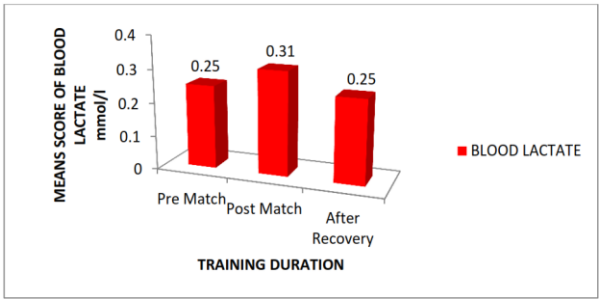

Figure-2 Marginal Means of Blood Lactate among Various recovery Durations

From table 5 it is evident that there was a significant main effect of training duration on Blood Lactate therefore to compare different times (i.e. pre match, post match and after recovery), pairwise comparisons were performed after Bonferroni adjustment, and the results are shown in the table-8.

Table-8

Pairwise Comparisons between recovery Durations of recovery programme of Blood Lactate

(I) Duration	(J) Duration	Mean Difference (I-J)	Std. Error	p-value	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
Pre Match	Post Match	-.05*	.01	.00	-.08	-.02
	After Recovery	.00	.01	1.00	-.02	.02
Post Match	After Recovery	-.05*	.00	.00	-.07	-.03
* The mean difference is significant at the .05 level.						
b. Adjustment for multiple comparisons: Bonferroni.						

Table 8 shows that significant differences were found between pre match- post match and post match- after recovery as the p-values were less than 0.05. Whereas no significant difference was found between pre match and after recovery as the p-value was greater than 0.05.

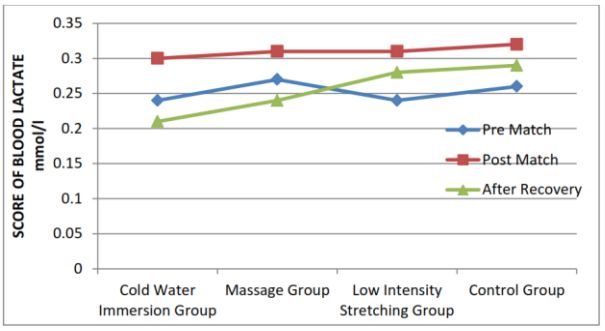

Figure-3 Graphical Representation of Mean Scores of Blood Lactate of Training Groups through Different Durations of Training

DISCUSSION

Attaining an adequate combination between training and competition load and recovery is very

essential for achieving top performance of athletes. Coaches and athletes used a wide range of recovery modalities after the training for proper recovery of the body and to attain balance between training load and recovery. Similarly present study was undertaken to investigate the comparative effect of different recovery programmes on Blood Lactate.

There was a significant effect of recovery durations on Blood Lactate ofthree groups (cold water immersion, massage and control group). When asses marginal means of Blood Lactate among recovery durations irrespective of groups of Blood Lactates variable.Themarginal mean of Blood Lactate for overall pre match irrespective of groups (cold water immersion, massage, low intensity stretching and control) suggests that its mean score and standard error are 0.25 and 0.01 respectively. The marginal mean of Blood Lactate for overall post match irrespective of groups (cold water immersion, massage, low intensity stretching and control) suggests that its mean score and standard error are 0.31 and 0.01 respectively. The marginal mean of Blood Lactate for overall after recovery irrespective of groups (cold water immersion, massage, low intensity stretching and control) suggests that its mean score and standard error are 0.25and 0.01 respectively.It is evident that there was a significant main effect of training duration. To compare different times (i.e. pre match, post match and after recovery), pairwise comparisons were performed after Bonferroni adjustment.Pairwise comparisons between recovery durations of recovery programme of Blood Lactate shows that significant differences were found between pre match- post match and post match- after recovery whereas no significant difference was found between pre match and after recovery. The significant change was found in Blood Lactate, among basketball players after administration of different recovery programs (Massage, cold water immersion & low intensity stretching recovery programs). It is very clear from the marginal means of Blood Lactate among recovery durations irrespective of groups of Blood Lactate, for the fast and better recover of basketball players, cold water immersion recovery programme was better than other recovery programme(massage, low intensity stretching and control programme)

Significant difference was found in Blood Lactate among basketball players after administration of different recovery programs (Massage, cold water & slow stretch recovery programs).It may be attributed due to the fact that the time duration which was 15 minutes appropriate to produce significant change in Blood Lactateamong different recovery programs. Further it can be concluded that cold water immersion recovery programme is better than other recovery programme to neutralize the blood lactate after the basketball match training load.

Finding of present study are in consonance of study conducted by Franchini et al. (2003), Spierer et al. (2004), Tessitore et al.(2007), Kinugusa&Kilding (2009), the effect of different recovery on hematological variables under different recovery programmes have been previously reported observed positive effects on perceived recovery (higher quality of recovery and lighter legs) after the combination modality (cold water immersion and active recovery). Signorile et al.(1993) indicated that active recovery provides superior performance to passive rest in repeated short-term, high intensity power activities. Weltman et al.(1979) studied performance after a 1-minute all-out cycle ergometry effort, followed by 20 minutes of active recovery or rest period. Active recovery produced higher pedal revolutions in repeated bouts, accompanied by increased lactate removal rates. A commonly investigated aspect of recovery is the physiological response of specific recovery modalities following exercise (Gill, Beaven, & Cook, 2006). Physiological markers used to assess recovery response usually are determined by the type of resultant fatigue induced by the exercise intervention (Smart, Gill, Beaven, Cook, &Blazevich, 2008). Typical methods employed to monitor recovery include the use of subjective muscle soreness ratings (King & Duffield, 2009; Sayers, Clarkson, & Lee, 2000; Tessitore, Meeusen, Pagano, Benvenuti, Tiberi, &Capranica, 2008; Weber, Servedio, & Woodall, 1994), strength and power measures to assess neuromuscular fatigue (King & Duffield, 2009; Tessitore, Meeusen, Pagano, Benvenuti, Tiberi, &Capranica, 2008; Weber, Servedio, & Woodall, 1994), limb range of movement (Sayers, Clarkson, & Lee, 2000), Blood Lactate (Coffey, Leveritt, & Gill, 2004; Connolly, Brennan, &Lauzon, 2003; Gupta, Goswami, Sadhukhan, &Mathur, 1996) and serum creatine kinase (Gill, Beaven, & Cook, 2006) which is used to monitor the rate and magnitude of change of muscle damage.

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